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ABSTRACT

The present invention relates to a filter assembly for filtering pollutants and debris from surface runoff water in stormwater drains. The filter assembly includes a flow guide which guides water from a chamber inlet to a chamber outlet, a diversion means for diverting a flow or part of a flow into a treatment portion of a chamber, and a return inlet for returning treated water to the flow guide for passage through the chamber outlet.

A FILTER ASSEMBLY

FIELD OF THE INVENTION

This invention relates to filter assemblies for drains such as stormwater drains for filtering runoff water prior to discharge. The invention has particular but not exclusive application as an in-line process filter for the filtering of stormwater, wastewater and runoff water. By way of example only, the present invention will be described hereinafter with reference to stormwater drains and drainage.

PRIOR ART

Stormwater drains often discharge directly into waterways and carry large amounts of debris and pollutants into the waterways. In recent years there has been a growing awareness of the need to minimise pollution resulting from surface water runoff.

The filtering of surface water runoff is a complex problem. One of the difficulties associated with filtering surface water runoff is that the pollutants can vary from being relatively large objects such as aluminium drink cans to sediment and organic debris to chemical pollutants such as oils and greases. A further problem associated with filtering surface water runoff is that the runoff may vary between a trickle and a full flow. A filtering apparatus must be capable of handling the full range of flows to work efficiently.

OBJECT OF THE INVENTION

It is an object of the present invention to provide a filtering assembly that alleviates at least one of the aforementioned problems associated with the filtering of surface water runoff.

SUMMARY OF THE INVENTION

The invention in one aspect broadly resides in a filter assembly including:

a flow guide extendable across a chamber providing a path between a chamber inlet and a chamber outlet;

a diversion means associated with the flow guide, said diversion means adapted to divert water from the flow guide; and

a return inlet means associated with the flow guide and adapted to return treated water to the flow guide or allow treated water to pass through to the chamber outlet wherein said return inlet is located downstream of said diversion means.

In a preferred form, the filter assembly is fitted and installed in the chamber. The chamber may be prefabricated, formed in situ or a pre-existing stormwater chamber.

The flow guide may be a substantially continuous or discontinuous path between the chamber inlet and the chamber outlet. In one form the flow guide is a discontinuous path adapted to direct the flow of water to the chamber outlet. In a preferred alternative form the flow guide is a substantially continuous path except for diversion means and return inlets located in the flow guide. Where the flow guide is substantially continuous as described above, the flow guide may be an open or substantially enclosed conduit.

In one preferred form the flow guide is an enclosed conduit except for apertures associated with the diversion means and the return inlet. The substantially enclosed conduit prevents mixing of treated water with untreated water except where treated water is introduced into the flow guide at the return inlet. The phrase "treated water" includes water in the chamber where the debris, sediment and other pollutants in the water have settled or floated to the surface. In a preferred embodiment of this form the flow guide is a substantially enclosed cylindrical pipe. The cylindrical pipe is preferably at least 0.9 times the internal diameter of the chamber inlet.

In another preferred form the flow guide is an open conduit serving to direct water rather than hold water. The flow guide may be any suitable shape such as a guide with a semicircular cross section. In one embodiment the flow guide may have a substantially flat suspended floor with a raised portion forming a weir member.

The flow guide is preferably downwardly inclined from the chamber inlet to the chamber outlet when installed. The flow guide is preferably downwardly inclined at a slight angle to minimise potential hydraulic head loss between the chamber inlet and the chamber outlet. In one embodiment the invert (bottom) of the chamber outlet is preferably between 0.005 and 0.015 times the length of the chamber lower than the invert of the chamber inlet.

When installed the diversion means is preferably in the flow guide and located near or adjacent the chamber inlet. The diversion means preferably includes an

aperture for diverting water into a treatment portion of the chamber. The treatment portion of the chamber is that portion below the diversion aperture and return inlet aperture. The diversion means preferably also includes a wall, weir or the like preventing a flow or part thereof from passing further along the flow guide.

In a preferred form the diversion means includes a diversion aperture with a forwardly inclined weir member extending forwardly and upwardly from the downstream side of the diversion aperture. The position of the weir member preferably provides diversion of a shallow flow into the chamber and diversion of part of a full flow into the chamber. The height and shape of the weir member is such that it preferably creates minimal turbulence in the downstream side of the flow guide. The weir member preferably extends to a height that substantially avoids the flow guide from being blocked by debris and litter. The angle of the weir member is preferably shallow (that is an acute angle) to direct water in a shallow flow and water in part of a full flow downwards into the chamber. Where the flow guide is an enclosed pipe, the inclined weir member is preferably wider than the flow guide to minimise head loss in full flow conditions.

The diversion means preferably includes sidewalls that substantially prevents water discharge from the chamber inlet escaping from the diversion means. The diversion means preferably also includes side chutes. In a preferred form there are chutes angled downwardly on either side of the aperture and extend from the sidewalls. The chutes preferably extend below the flow guide to prevent debris and pollutants such as oil and other hydrocarbons from re-entering the flow guide.

Where the chamber inlet has a circular cross section, the diversion means is preferably a flow control unit having an overall length between 1.5 to 4 times the internal diameter of the chamber inlet. The width of the unit is preferably between 1.5 and 3.5 times the internal diameter of the chamber inlet and the height of the sidewalls are greater than 0.9 times the internal diameter of the chamber unit above the side chutes. The height of the inclined weir member is preferably between 0.2 and 1.0 times the internal diameter of the chamber inlet above the invert (bottom) of the chamber inlet. The length of the inclined weir member is preferably between 0.5 and 2.0 times the internal diameter of the chamber inlet. The width of the inclined weir member is preferably determined by the overall width of the flow control unit and the side chutes. The height of the side chutes is preferably between 0.25 and 1.0 times the internal diameter of the chamber inlet and do not protrude beneath the

bottom of the invert of the chamber inlet by greater than 100mm. The width of the opening between the side chutes is preferably between 0.75 and 2.0 times the internal diameter of the chamber inlet.

The return inlet is preferably an aperture in the flow guide downstream of the diversion aperture. The return inlet may alternatively be a gap between the discontinuous flow guide and the chamber outlet. The return inlet allows water in the treated portion of the chamber to return to the flow guide to be discharged from the chamber outlet or simply discharged from the chamber guide.

The return inlet in one alternate form does not have a screen. In a preferred form the return inlet includes a screen to prevent debris from passing through the inlet aperture. The screen may be a vertical, horizontal or inclined screen. Preferably the screen is a tapered inclined filter screen. The tapering of the filter screen extends from the aperture of the return inlet to within the chamber. Preferably the filter screen is in the shape of an inverted cone or pyramid. With the tapering of the filter screen the inlet area is maximised whilst having a self cleaning operation allowing debris and litter to fall from the screen as the water level rises and falls.

In a preferred form the return inlet includes an inverted conical screen mounted about an inlet aperture in the flow guide. The height of the inverted conical screen is preferably between 0.7 and 3.0 times the internal diameter of the chamber inlet. The base diameter of the inverted conical screen is preferably between 0.7 and 1.5 times the internal diameter of the chamber inlet and fits tightly over the inlet aperture. The diameter of the truncation of the inverted conical screen is preferably between 20mm and 100mm. Preferably the area of the inverted conical screen is greater than twice the area of the chamber inlet.

In one preferred embodiment there is an inspection port which allows the screen to be inspected and serviced. In one preferred embodiment the internal diameter of the return inlet is between 0.6 and 1.1 times the internal diameter of the chamber inlet.

In one preferred embodiment the horizontal distance from the closest edge of the return inlet to the chamber outlet is preferably between 60mm and 250mm.

In another aspect the invention broadly resides in a filter assembly including

a flow guide extendable across a chamber providing a path between a chamber inlet and a chamber outlet;

a diversion means associated with the flow guide, said diversion means has a substantially upright front wall opposing the chamber inlet, a top wall and a rear wall; and

a return inlet means associated with the flow guide and adapted to return treated water to the flow guide and pass through to the chamber outlet wherein said return inlet is located downstream of said diversion means.

The flow guide in one embodiment is supported between the chamber inlet and outlet without abutting the chamber inlet wall or the chamber outlet wall. In this embodiment the substantially upright front wall of the diversion means is the front end of the flow guide. The front wall of the diversion means is spaced apart from the chamber inlet wall and positioned within the chamber to allow water from a full flow to pass over the diversion means and water from a shallow flow to pass between the chamber inlet wall and the upright front wall of the diversion means. The upright front wall of the diversion means may vary 15 degrees from the perpendicular. The rear wall of the diversion means serves as the rear end of the flow guide and may extend below the lower end of the front wall so as to collect and prevent debris from passing through the chamber outlet. In this embodiment the rear wall of the diversion means is spaced from the chamber outlet wall to enable water to pass between the rear wall and the chamber outlet wall to the chamber outlet.

In another embodiment the flow guide abuts both the chamber inlet wall and chamber outlet wall. Preferably the flow guide sealably connects to the chamber inlet wall and the chamber outlet wall. Adjacent the chamber inlet wall there is preferably opposing sidewalls angled to divert water to an aperture in the flow guide located in before the front wall of the diversion means. The sidewalls of the flow guide are preferably spaced apart at a distance corresponding to the diameter of the chamber inlet. The sidewalls substantially prevent debris and other pollutants stored below the flow guide from passing back through the aperture and causing a blockage or being carried over the diversion means. The upright front wall of the diversion means may vary 15 degrees from the vertical plane. The height of the front upright wall may vary depending on the amount of flow desired to pass over the diversion means. The upright front wall serves to direct water through the aperture causing minimal turbulence and agitation of the water stored below the sidewalls. The top wall is substantially flat. The rear wall preferably extends below the lower end of the front wall. The rear wall preferably extends substantially along the vertical plane but

may vary up to 15 degrees from the vertical plane. Between the rear wall and the chamber outlet wall, there is a rear portion of the flow guide which is substantially flat and relatively lower in position than either the sidewalls or the top wall of the flow guide. In the rear portion of the flow guide there is located a return inlet for treated water to pass through and be discharged through the chamber outlet. The return inlet may include a downwardly extending pipe means. The return inlet may also include a screen or take an alternate form as described above.

An advantage of this embodiment is that the flow guide with the diversion means is relatively simple and cheap to manufacture compared with other flow guides.

Where there is an opening in the top of the chamber there is preferably a deflector member that is adjacent the opening. The deflector member serves to deflect water to the aperture in the flow guide.

In a preferred embodiment of the filter assembly as described in the current aspect of the invention there is an opening in the top wall of the chamber which is approximately 700mm in diameter. The deflector member is approximately 320mm in length and extends inwardly and downwardly from one end of the opening in the top wall of the chamber at an angle of approximately 45 degrees from the vertical plane. The lower end of the deflector member has a downwardly extending flange of approximately 20mm in length. The flange is spaced from the flow guide by approximately 150mm to form an opening through which a flow of water may pass. The sidewalls of the flow guide are approximately 445mm long and 250mm wide. The sidewalls of the flow guide are spaced apart at a distance corresponding to the diameter of the chamber inlet which in this embodiment is approximately 230mm. The distance between the top chamber wall and the top of the chamber inlet is approximately 200mm. The front upright wall of the diversion means is approximately 40mm in height while the top wall of the diversion means is 450mm in length and the rear wall of the diversion means is 125mm in height. The rear portion of the flow guide which extends between the rear wall of the diversion means and the chamber outlet wall is approximately 600mm in length. Both the top wall of the diversion means and the rear portion of the flow guide is substantially flat and planar in structure. The rear portion of the flow guide sealably abuts the chamber outlet wall adjacent substantially the lowest point on the periphery of the chamber outlet. The rear portion of the flow guide has a return inlet which has a diameter of

approximately 300mm and located approximately 120mm form the chamber outlet wall. The return inlet also includes a pipe that extends downwardly approximately 150mm into the lower part of the chamber.

In another aspect the invention broadly resides in a filter assembly including:

a chamber;

a flow guide extending across the chamber and providing a path between a chamber inlet and a chamber outlet;

a diversion means associated with the flow guide, said diversion means being able to divert flow from the flow guide to the chamber; and

a return inlet associated with the flow guide adapted to return treated water to the flow guide wherein said return inlet is downstream from said diversion means.

The filter assembly preferably serves as a unit for installation in a stormwater drainage system. The chamber serves as an integral part of the filter assembly providing housing for the flow guide diversion means and return inlet. The chamber preferably allows various types of pollutants and debris to settle or separate from the water (that is, come out of suspension) and rise to the surface. The chamber preferably provides storage of collected pollutants.

The chamber may be a prefabricated chamber. For smaller chambers the chamber may be a modular precast concrete chamber. With larger chambers, the chamber may be made in parts and assembled on site or at the factory. Each chamber preferably has one or more access openings for inspection, cleaning out of pollutants and debris and for general maintenance.

The chamber may have an opening in the roof of the chamber for surface run off water to pass through and into the chamber. The opening in the chamber roof may be the only entrance for water into the chamber or be a further site of entry in association with one or more inlet pipes. The opening in the roof of the chamber is preferably above the diversion means. Preferably there are one or more deflector members between the roof opening and the diversion means for directing the water into the treatment portion of the chamber and substantially avoid passing along the flow guide. When the flow entering the chamber through the roof opening and or inlet pipe is such that water accumulates in the treatment portion of the chamber and begins to overflow, the flow guide preferably serves as a bypass for the accumulated and or incoming water. The roof opening is preferably covered by a removable or hinged grate. The roof opening is preferably at the same level as the surrounding

ground. The roof opening may be at the pavement, roadway, or gutter level. The passage from the roof opening preferably directs surface water into the treatment portion of the chamber forcing treated water out through the return inlet.

The chamber may have one or more inlets that open adjacent the diversion means. In one form there maybe one or more chamber inlets on adjacent walls. One or more deflector members are preferably suitably positioned to form weir members.

The chamber may have the chamber outlet on a wall not in a direct line with the chamber inlet. In one embodiment the chamber outlet is in a sidewall and adjacent the chamber rear wall.

The description of the flow guide, diversion means and return inlet that is described above in the different variations and embodiments also applies to this aspect of the invention.

The length of the chamber is preferably between 3 and 10 times the internal diameter of the chamber inlet. The embodiment also has a length of at least 1.5 times greater than the width of the chamber.

The depth of the chamber below the chamber inlet preferably provides for a floatable storage zone, a treatment zone and solids storage zone. The treatment zone is the region where water enters the chamber from the diversion means. The treatment zone is of sufficient depth to reduce the velocity of the flow entering from the diversion means. The depth and length of the treatment zone is dependent on the angle of the weir member which directs water into the chamber. Preferably the angle of the inclined weir member is shallow. It is preferable that the diversion aperture be sufficiently spaced from the inlet aperture to avoid the incoming flow from immediately escaping through the return inlet aperture.

The floatable storage zone is that region in the chamber adjacent the flow guide and above the treatment zone. In the floatable storage zone, pollutants such as oils, hydrocarbons and gross litter which float on water are kept from entering the flow guide at the return inlet.

The solids storage zone is substantially at the bottom region of the chamber. Preferably the solid storage zone is large enough to contain a variety of debris such as cans, leaf litter, aggregates and silt.

In another aspect the invention is a method of treating water including:

providing a filter assembly as described above to receive flows through a common inlet;

diverting water from a flow into a chamber allowing water from an excess flow to pass along a flow guide and through a chamber outlet;

treating water in the chamber;

discharging treated water from the chamber through a return inlet along the flow guide and through the chamber outlet.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that this invention be more readily understood, reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention and wherein:

Fig. 1 is a diagrammatic view of the filter assembly;

Fig. 2 is a plan view of the filter assembly;

Fig. 3 is a side view of the filter assembly;

Fig. 4 is an end view of the chamber inlet of the filter assembly;

Fig. 5 is a plan view of the flow control unit;

Fig. 6 is a section view (section A-A) of the flow control unit;

Fig. 7 is a perspective view of the flow control unit;

Fig. 8 is a section view (section B-B) of the flow control unit;

Fig. 9 is a diagrammatic view of another embodiment of the inverted conical screen;

Fig. 10 is a photograph of the flow control unit; and

Fig. 11 – 13 are alternative embodiments of the invention.

Fig.14 and 15 are further alternative embodiments of the invention.

Fig. 16 and 17 are alternative views of a preferred embodiment of the invention.

Fig. 18 is a sectional view through the sidewalls of the preferred embodiment shown in Figures 16 and 17.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to Figure 1 there is shown a filter assembly 10, including chamber 11, a flow guide in the form of a flow control unit 12 and an enclosed pipe 13, and a return inlet 14 located below in the enclosed pipe 13 and in communication

with the enclosed pipe 13. The chamber 11 has a floor 15, sidewalls 16 and top wall 17 (shown in Figures 3 and 4). The top wall 17 has one or more access openings (not shown) to provide access to the interior of the chamber 11.

The flow control unit 12 as shown in Figures 1 to 8 and 10 is located adjacent to the chamber inlet 20 and pipe inlet 22. Flow control unit 12 has sidewalls 21 which restricts the passage of water discharged from chamber inlet 20 to pass through either pipe inlet 22 or diversion aperture 23. The water discharged from chamber inlet 20 is subject to diversion by weir 24. Weir 24 extends upwardly and forwardly at an inclined angle from a rear edge of the diversion aperture 23. The weir 24 serves to divert water discharged from chamber inlet 20 into the interior of chamber 11 or pass along pipe 13. In the case of a shallow flow where the flow of water does not exceed the height of the weir 24, the water is diverted into the interior of chamber 11. In the case of full flows, water from part of the flow is diverted by the weir 24 into the interior of the chamber 11. The greater the height of the weir 24, the greater is the amount of water diverted into the interior of chamber 11. Weir 24 is attached to chutes 25 which extend downwardly from the sidewalls 21. The chutes 25 extend below the lower level of the pipe 13.

The weir 24 is attached at its side edges to the chutes 25 to create a valley 26 which directs water flowing over the weir 24 towards pipe inlet 22. Adjacent the weir 24 is an intermediate member 27 which serves to pass water to the pipe inlet 22.

Water passing through the chamber inlet 20 may be diverted into the chamber 11 through diversion aperture 23. The diverted water enters the chamber 11 to the treatment zone 30. At the treatment zone 30 debris such as sediment and other non-floating litter sink towards the chamber floor 15 and form the solids storage zone 31. Pollutants such as oil and hydrocarbons and other floatable debris rise towards the water level surface to form the floatable storage zone 32. The pollutants and other floatable debris are substantially prevented from entering the diversion aperture 23 by the chutes 25 and weir 24 which extend below the bottom level of pipe 13.

The return inlet 14 includes an inlet aperture 35 in the pipe 13 and downstream of the diversion aperture 23. The inlet aperture 35 is surrounded by an inverted conical screen 36 (shown also in another embodiment in Fig. 9 where there is conical portion 37a and mesh wall 40a). The inverted conical screen 36 has a conical portion 37 and cylindrical portion 38. The cylindrical portion 38 is mounted

about inlet aperture 35 and extends downwardly from the inlet aperture 35. The cylindrical portion 38 has an enclosed outer wall 39 which prevents pollutants and floatable debris from passing therethrough. The conical portion has a mesh 40 which allows water but not debris larger than the pore size of the mesh to pass through the mesh wall 36 and subsequently to inlet aperture 35. The inverted conical shape of screen 36 provides an increased surface area through which water may pass. The inverted conical shape of screen 36 also facilitates the removal of debris and litter from the mesh screen as the flow in the chamber changes in velocity. Because the pipe 13 is downwardly inclined to facilitate the passage of water along pipe 13, the inlet aperture 35 is lower than the diversion aperture 23. Consequently, water in the chamber 11 will preferentially be discharged through inlet 35.

There is also an inspection port 41 mounted on an upper side of pipe 13 to provide inspection of the inverted conical screen 36.

Water passing through the conical portion 37 and inlet aperture 35 passes along pipe 13 towards chamber outlet 42. The water is subsequently discharged from the filter assembly 10 through chamber outlet 42.

In the case of flows that do not pass over the weir 24 the water is directed into the chamber 11 where it is treated. The in-flowing water displaces the previously treated water via a head differential between the weir 24 and the inlet aperture 35.

When there is a full flow part of the water is diverted into the chamber 11 while the water flowing over the weir 24 enters pipe inlet 22 and passes along pipe 13 for discharge from the filter assembly 10.

In figures 11, 12 and 13 there are shown alternative embodiments of the filter assembly. In figure 11 there is shown a chamber 51 with a flow guide 52 suspended within the chamber 51 and between the chamber inlet 53 and chamber outlet 54. The flow guide 52 has an inclined portion 55 that forms a weir. An alternate inclined portion 56 is shown in phantom. The alternate inclined portion 56 has a steeply inclined end section 57 that substantially forms the weir. Located within the guide flow 52 is a return inlet 58 which includes a downwardly extending cylindrical portion 59 with an opening 60. In a further alternative embodiment there may be an inverted conical screen extending downwards from the end of the cylindrical portion 59. In use water entering the chamber 51 is diverted by the weir 55 (57) into the treatment portion 61 of the chamber 51. Treated water flows through the opening 60,

cylindrical portion 59 and out through the chamber outlet 54. The flow guide 52 in association with the return inlet 58 captures floatable pollutants in the defined space 62.

With reference to figure 12 there is shown a chamber 70 having a chamber inlet 71 and a chamber outlet 72. Within the chamber 70 there is a suspended flow guide 73. The flow guide 73 has an inclined portion 74 with an end that forms a weir. The inclined portion 74 may have an alternative shape where the end section 75 is steeply inclined to form a weir. The return inlet 76 may simply be the gap provided between the flow guide 73 and the rear wall 77 of the chamber 70. The return inlet 76 may include a substantially vertical screen 78 extending between the end of the flow guide 73 and the base wall 79 of the chamber 70. The vertical screen 78 may extend partly or completely to the base wall 79. In an alternative embodiment the return inlet may not have a vertically extending screen.

With reference to figure 13 there is shown a chamber 80 which has a chamber inlet 81 and a chamber outlet 82. In this embodiment the flow guide is a divided section 83 with an intermediate wall 84 and a base wall 85. There is a weir 86 that extends from the intermediate wall 84. The intermediate wall 84 also has an aperture (not shown) to allow overflow water to enter the divided section 83. The base wall 85 has a return inlet 87 where treated water may pass through and enter the divided section 83. The return inlet 87 includes an aperture (not shown) in the base wall 85, a cylindrical portion 88 extending downwardly from the aperture in the base wall 85 and an inverted conical screen 89 extending downwardly from the end of the cylindrical portion 88. There is also shown a deflector 90 extending from the intermediate wall 84 for deflecting water away from the aperture in intermediate wall 84. The deflector 90 deflects water entering the chamber 80 from an opening in the chamber roof. Figure 13 also shows in phantom alternate chamber inlet 91 and alternate chamber outlet 92 in the sidewall 93 of the chamber 80.

With reference to Figure 14 there is shown a filter assembly 100 having a chamber 101 and a flow guide 102 supported within the chamber 101. There is a chamber inlet 103 and an opposing chamber outlet 104 positioned relatively lower in the chamber 101 than the chamber inlet 103. The flow guide 102 has a front wall 105 that is substantially upright and opposes the chamber inlet 103. The front wall 105 is spaced from the chamber inlet 103 to allow water from shallow flows to enter the chamber 101 below the flow guide 102. With a full flow, some of the water may

pass over the flow guide 102 and be discharged through the chamber outlet 104 and some of the water may enter the chamber 101 between the chamber inlet wall 106 and the front wall 105. The flow guide 102 is of relatively simple construction with the upright front wall 105, a substantially flat top wall 107 and a downwardly extending rear wall 109. The rear wall 109 extends downwardly beyond the lower end of the front wall 105. The rear wall 109 serves to collect debris and larger sized pollutants such as plastic bottles preventing them from being discharged through the chamber outlet 104. Water that has entered into the lower part of the chamber 101 may pass out of the chamber 101 by flowing around the rear wall 109 and through to the chamber outlet 104.

With reference to Figure 15 there is shown a chamber 110 having a chamber inlet 111 and chamber outlet 112. There is a flow guide 113 supported within the chamber 110. The flow guide 113 has a front wall 114 extending downwardly from a top wall 115. The front wall 114 opposes and is spaced apart from the chamber inlet 111. The rear wall 116 extends downwardly from the top wall 115. The rear wall 116 extends to a position lower than lower end of the front wall 114. The rear portion 117 of the flow guide 113 extends from the rear wall 116 to the outlet chamber wall 118. The rear portion 117 is substantially flat and planar. The rear portion 117 has a return inlet 119 with a downwardly extending pipe 120. The return inlet 119 allows water in the lower part of the chamber 110 to pass through the flow guide 113 and discharged from the chamber outlet 112. The pipe 120 extends downwardly into the lower part of the chamber 110 and serves to prevent floatable debris and hydrophobic compounds such as oil from passing through the return inlet 119.

With reference to Figures 16, 17 and 18, there is shown a further alternative embodiment of the filter assembly with a flow guide 130 having opposed sidewalls 131 angled downwardly towards an aperture 132. The sidewalls 131 are spaced apart at a distance of approximately the diameter of the chamber inlet 143. The sidewalls 131 are angled downwardly relative to the aperture 132 and about the chamber inlet 143 (see figure 18). The sidewalls 131 abut a substantially upright front wall 133 to provide a weir type structure that directs water through the aperture 132 creating minimal agitation of water, debris and pollutants retained below the sidewalls 131. The front wall 133 may vary approximately 15 degrees from the vertical plane but is preferably approximately 90 degrees. The substantially upright front wall 133 provides an advantage over an inclined weir type structure by stopping

the momentum of the water that collides with it and allowing the water to fall through the aperture 132. Inclined weir type structures sometimes causes an accumulation of turbulent water upstream thereby producing flow problems. The flow guide 130 has a substantially flat top wall 134, a downwardly extending rear wall 135 and a rear portion 136 extending from the rear wall 135. When the flow guide 130 is positioned within the chamber 140, the rear wall 135 extends below the lower end of the front wall 133. The rear portion 136 has a return inlet 137 with a downwardly extending pipe 138. In Figure 17 there is shown a chamber 140 with the sidewalls 131 sealingly abutting the chamber inlet wall 138 and the rear portion 136 sealingly abutting the chamber outlet wall 139 at a position that is adjacent the lowest point of the periphery of the chamber outlet.144. The chamber 140 has an opening 141 in the top wall of the chamber through which water may flow into the chamber 140. The chamber opening 141 may typically be covered by a grate or form part of a culvert, gutter or storm water drain. Water entering through the chamber opening 141 may be deflected by deflector 142 which is positioned to direct water to the aperture 132. The deflector 142 is angled at approximately 45 degrees downwardly and inwardly. At the lower end of the deflector 142, there is a downwardly extending flange 145 that defines an opening with the flow guide 130 for the diversion of water over the flow guide 130. Water entering through the aperture 132 from either the chamber opening 141 or the chamber inlet 143 passes into the lower part of the chamber 140. The sidewalls 131 serve not only to direct water into the aperture 132 but also to retain litter, debris and other pollutants such as oil from passing back through the aperture 132. The sidewalls 131 also assist in guiding water to the return inlet 137. From the return inlet 137, water then flows out of the chamber 140 through the chamber outlet 144. The preferred embodiment shown in figures 16 and 17 has an advantage in that it is a comparatively simple and inexpensive filter assembly to manufacture and install.

One of the advantages of the filter assembly of the preferred embodiment is that it can handle both shallow and full flows. Another advantage of one or more of the preferred embodiments is the removal of pollutants such as oils, greases, and hydrocarbons, sediment and aggregates, litter such as plastics, paper, cans, bottles and cigarette butts, and or organic matter such as leaf litter and grass clippings. The filter assembly of the preferred embodiment also provides minimal hydraulic head loss between the chamber inlet and chamber outlet. The filter assembly of the

preferred embodiment is relatively simple in construction and requires minimum excavation for installation. As well the collected pollutants and debris can be removed from the filter assembly of the preferred embodiment through an access opening. The access opening can also allow general maintenance of the filter assembly.

It will of course be realised that while the aforegoing has been given by way of example, all such and other modifications and variations thereto as would be apparent to a person skilled in the art deemed to fall within broad scope and ambit of this invention as herein set forth.

CLAIMS

1. A filter assembly for installation in a chamber including:
a flow guide extendable across the chamber providing a path between a chamber inlet and a chamber outlet;
a diversion means associated with the flow guide, said diversion means adapted to divert water from the flow guide; and
a return inlet associated with the flow guide and adapted to return treated water to the flow guide or allow treated water to pass through to the chamber outlet wherein said return inlet is located downstream of said diversion means.

2. A filter assembly as claimed in claim 1 wherein the diversion means includes an aperture associated with the flow guide and a weir member adapted to divert a flow through the aperture.

3. A filter assembly as claimed in claim 2 wherein the weir member extends forwardly and upwardly from the downstream side of the diversion aperture.

4. A filter assembly as claimed in claim 3 wherein the return inlet includes an inlet aperture located downstream of the diversion aperture.

5. A filter assembly as claimed in claim 4 wherein the return inlet also includes an inverted conical screen extending downwards from the inlet aperture.

6. A filter assembly including:
a chamber;
a flow guide extending across the chamber and providing a path between a chamber inlet and a chamber outlet;
a diversion means associated with the flow guide, said diversion means being able to divert flow from the flow guide to the chamber; and

a return inlet associated with the flow guide adapted to return treated water to the flow guide wherein said return inlet is downstream from said diversion means.

7. A filter assembly as claimed in claim 6 wherein the diversion means includes an aperture associated with the flow guide and a weir member adapted to divert a flow through the aperture, said weir member extends forwardly and upwardly from the downstream side of the diversion aperture.

8. A filter assembly as claimed in claim 7 wherein the return inlet includes an inlet aperture located downstream of the diversion aperture and an inverted conical screen extending downwards from the inlet aperture.

9. A filter assembly as claimed in any one of claims 6, 7 and 8 wherein the chamber has an opening in the chamber roof substantially above the diversion means for the passage of surface run off water into the chamber.

10. A filter assembly as claimed in claim 9 wherein there are one or more deflector members for directing surface run off water into a treatment portion of the chamber.

11. A filter assembly as claimed in any one of claims 6, 7 and 8 wherein there are two or more chamber inlets that are on adjacent chamber walls and adjacent the diversion means.

12. A filter assembly as claimed in claim 11 wherein there is a deflector forming a weir member suitably positioned relative to the chamber inlet and the flow guide.

13. A filter assembly including

a flow guide extendable across a chamber providing a path between a chamber inlet and a chamber outlet;

a diversion means associated with the flow guide, said diversion means has a substantially upright front wall opposing the chamber inlet, a top wall and a rear wall; and

a return inlet means associated with the flow guide and adapted to return treated water to the flow guide and pass through to the chamber outlet wherein said return inlet is located downstream of said diversion means.

14. A filter assembly as claimed in claim 13 wherein the substantially upright front wall of the diversion means is the front end of the flow guide and the front wall of the diversion means is spaced apart from the chamber inlet wall and positioned within the chamber to allow water from a full flow to pass over the diversion means and water from a shallow flow to pass between the chamber inlet wall and the upright front wall of the diversion means.

15. A filter assembly as claimed in claim 13 wherein the upright front wall of the diversion means can vary 15 degrees from the perpendicular.

16. A filter assembly as claimed in claim 13 wherein the rear wall of the diversion means serves as the rear end of the flow guide and extends below the lower end of the front wall so as to collect and prevent debris from passing through the chamber outlet.

17. A filter assembly as claimed in claim 13 wherein the flow guide abuts both the chamber inlet wall and chamber outlet wall, said chamber inlet wall has opposing sidewalls angled to divert water to an aperture in the flow guide located adjacent the front wall of the diversion means.

18. A filter assembly as claimed in claim 13 wherein the sidewalls of the flow guide are spaced apart at a distance substantially corresponding to the diameter of the chamber inlet and positioned to substantially prevent debris and other pollutants stored below the flow guide from passing back through the aperture.

19. A filter assembly as claimed in claim 13 wherein a rear portion of the flow guide is substantially flat and relatively lower in position than either the sidewalls or the top wall of the flow guide, said rear portion has a return inlet for treated water to pass through and be discharged through the chamber outlet.

20. A filter assembly as claimed in claim 13 wherein there is an opening in the top of the chamber and there is a deflector member adjacent the opening for deflecting water to the aperture in the flow guide.

21. A filter assembly as claimed in claim 13 wherein the top wall of the diversion means and a rear portion of the flow guide is substantially flat and planar in structure, said rear portion of the flow guide sealably abuts the chamber outlet wall adjacent substantially the lowest point on the periphery of the chamber outlet.

22. A filter assembly as substantially described herein with reference to and as illustrated by the accompanying drawings.

DATED THIS TWENTY THIRD DAY OF AUGUST 2002

CENTRAL MORETON INDUSTRIES PTY LTD
And
DH ENVIRONMENTAL PTY LTD
by its Patent Attorneys
WYNNES PATENT AND TRADE MARK ATTORNEYS

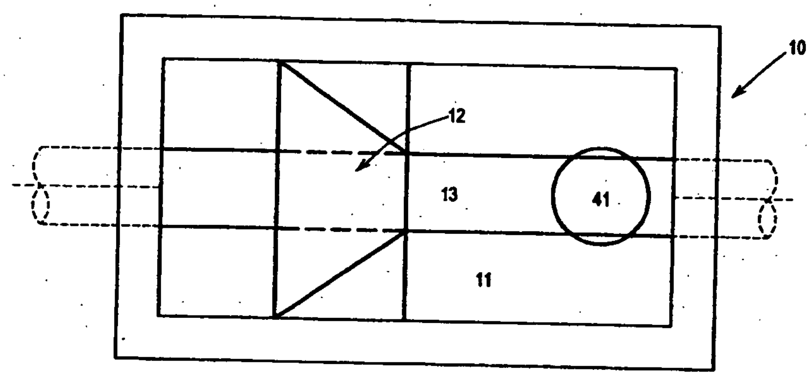


Figure 2

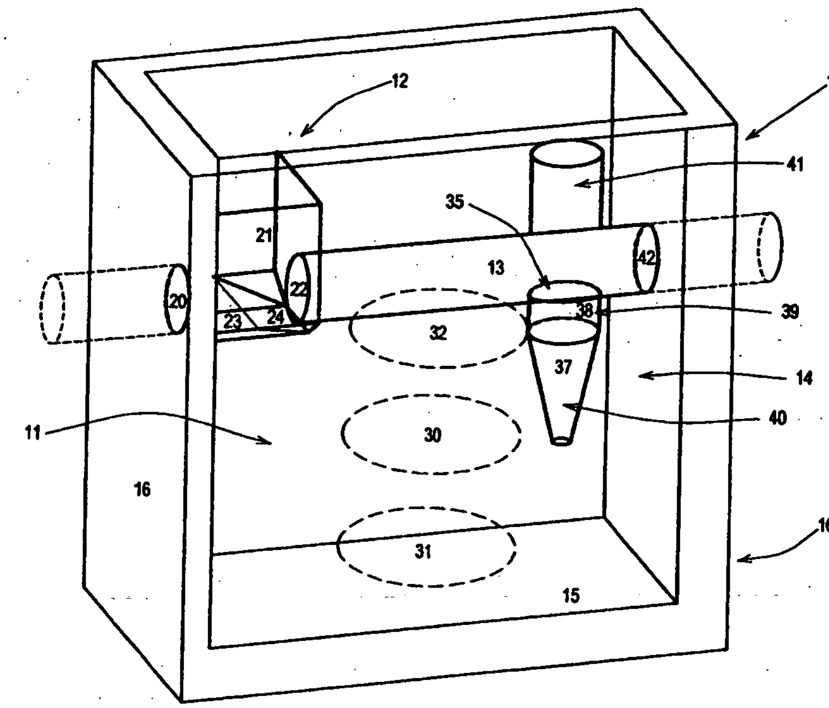
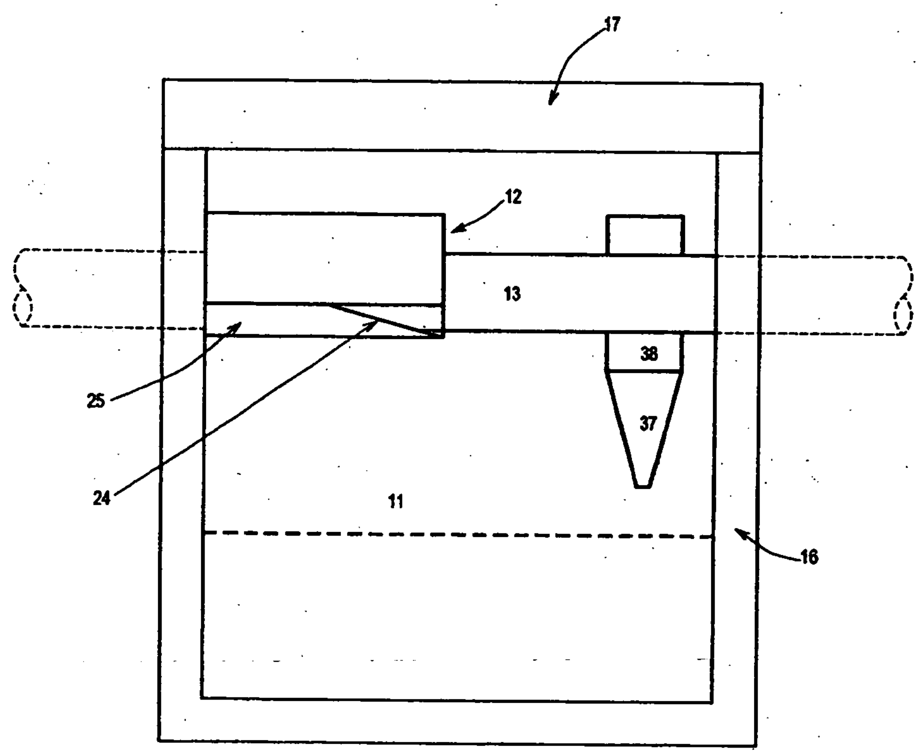


Figure 1



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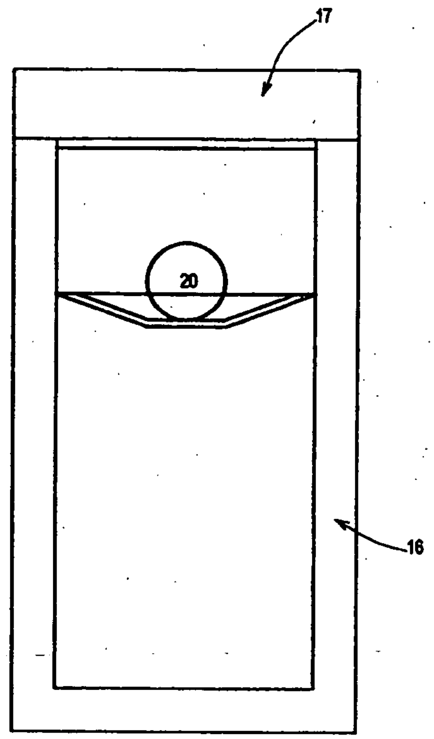

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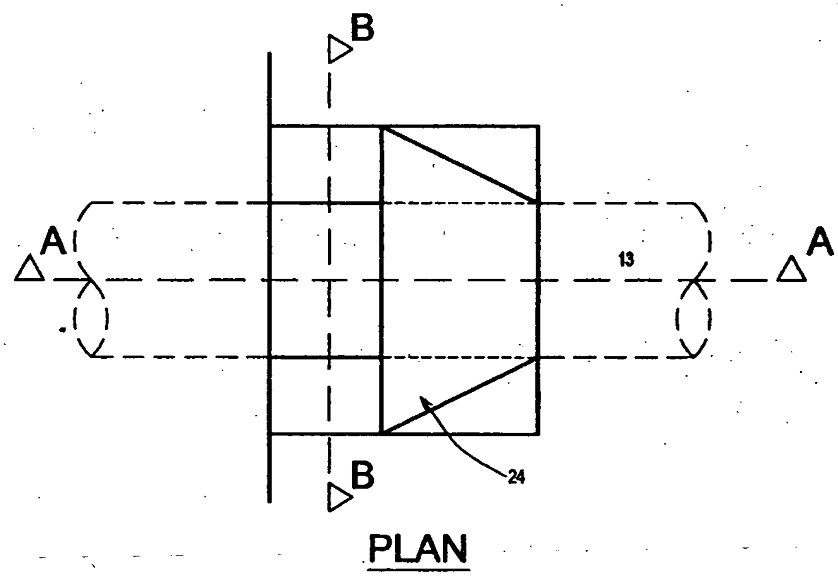

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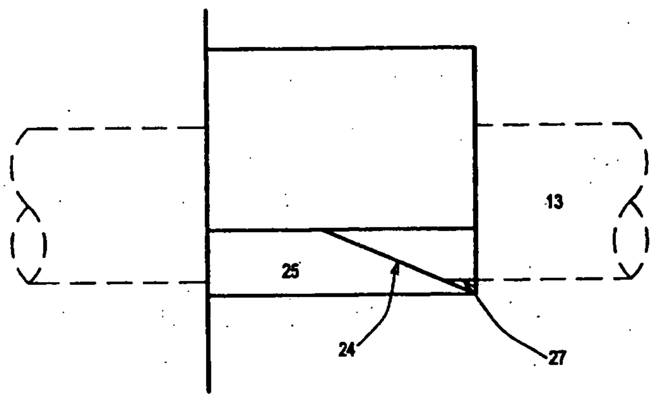
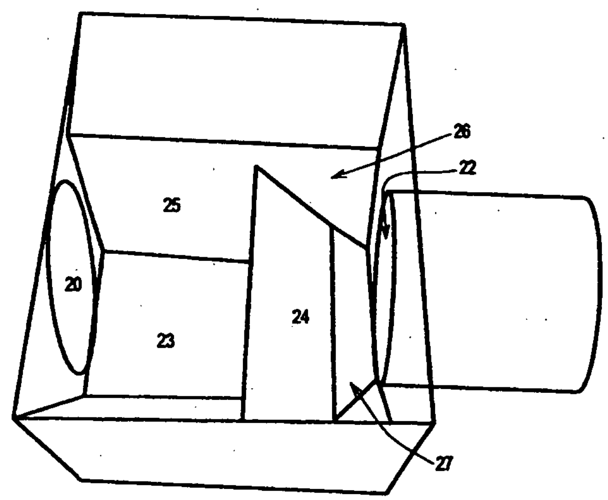


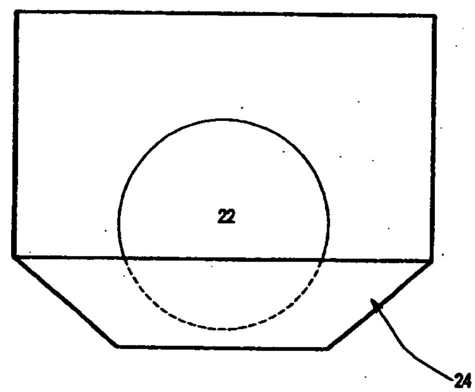
SECTION A-A

Figure 6



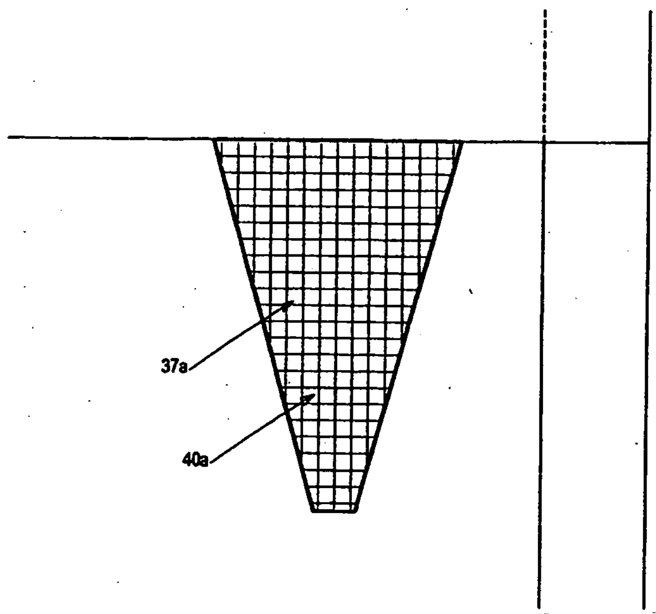
PERSPECTIVE

Figure 7



SECTION B-B

Figure 8



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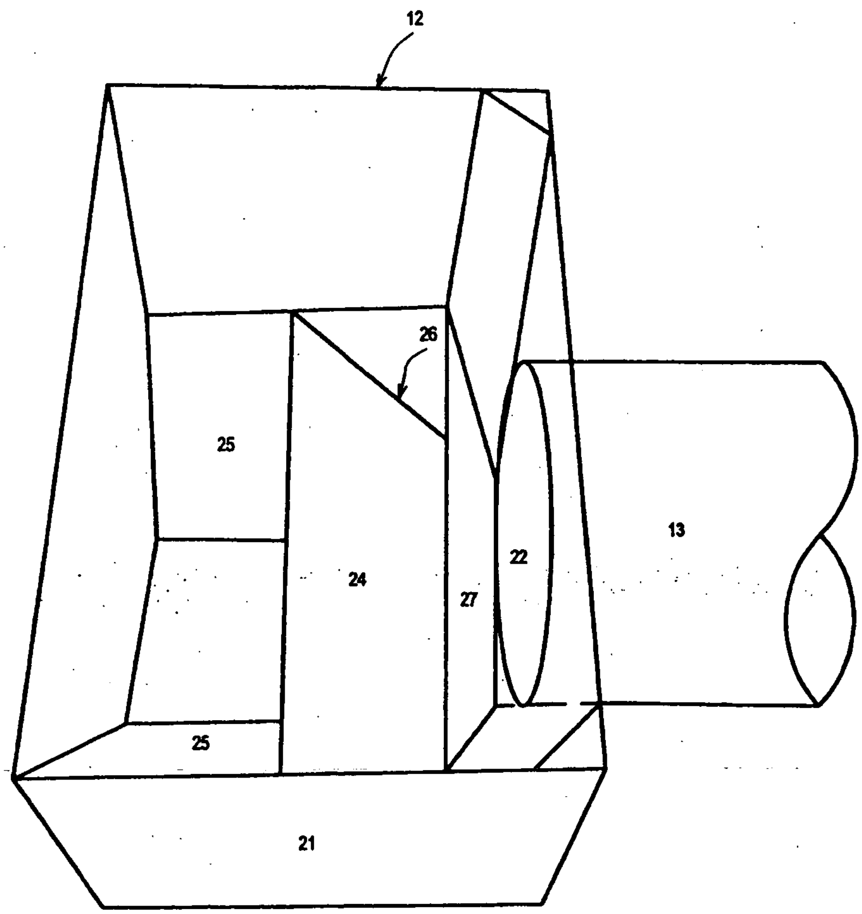
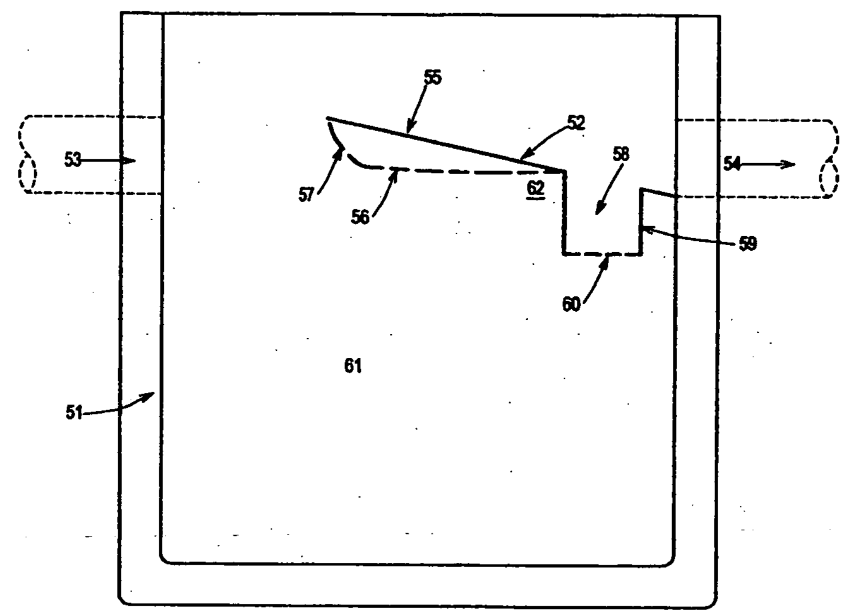


Figure 10



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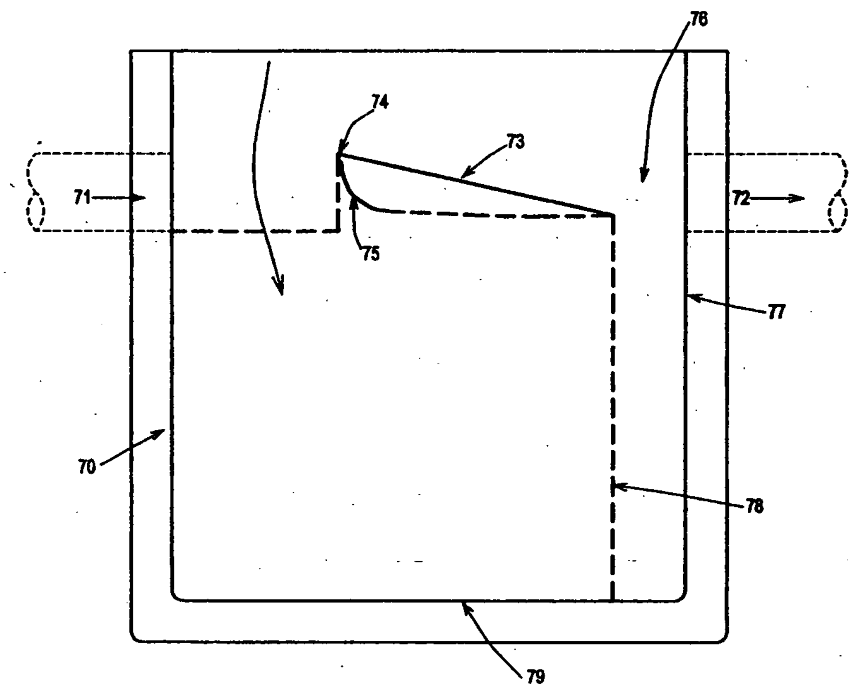

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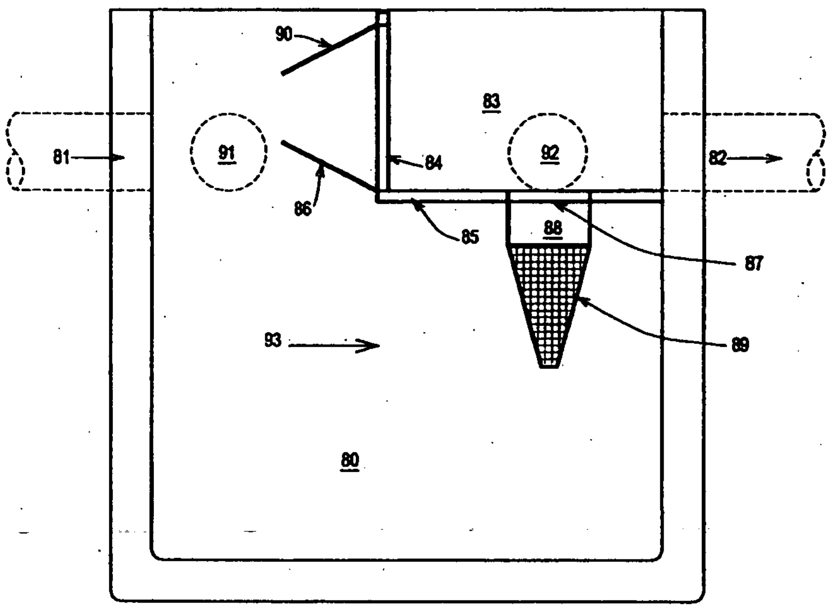

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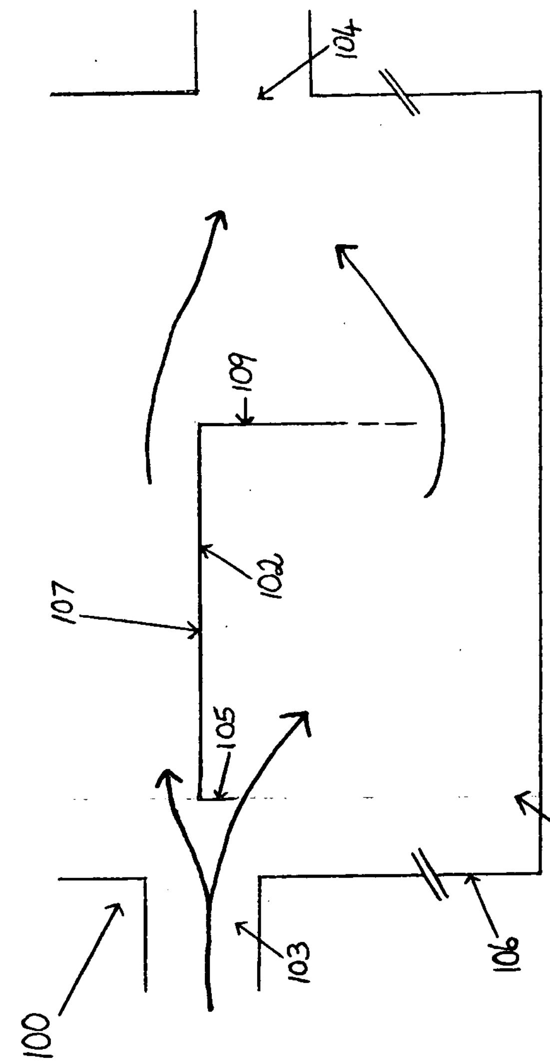

Fig. 14

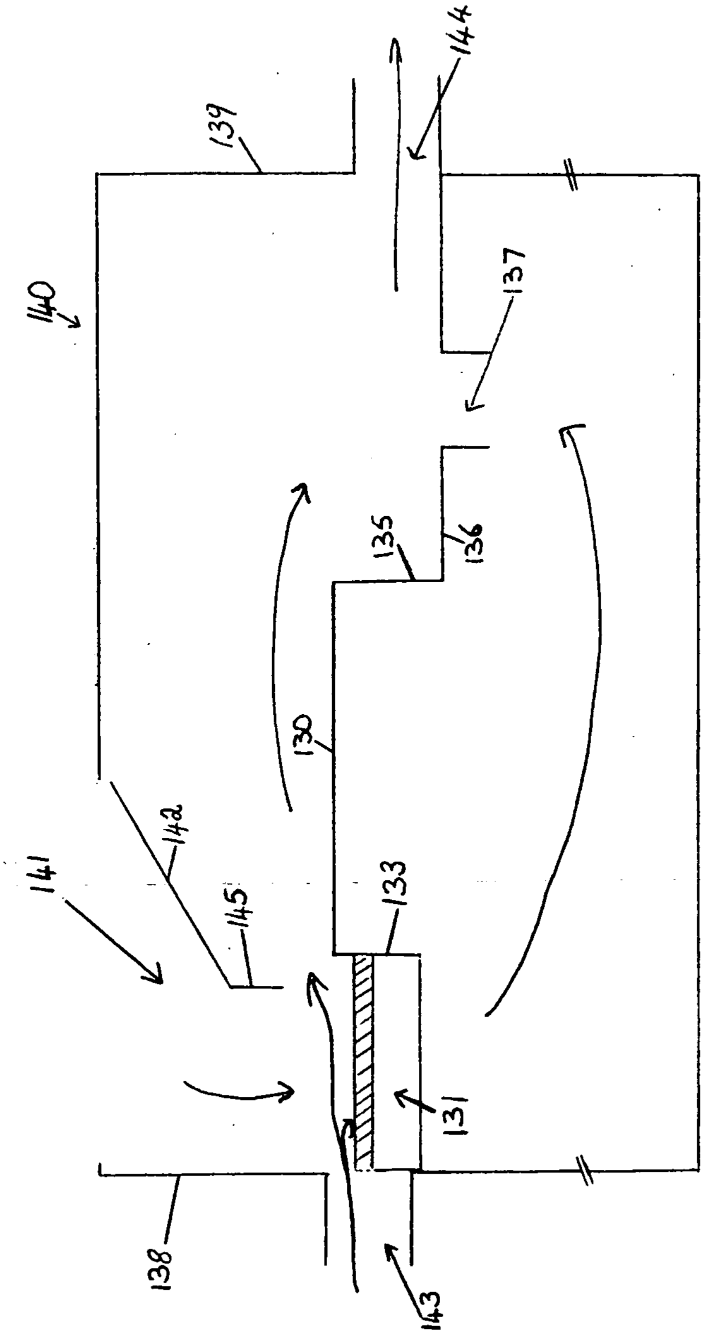

Fig. 17

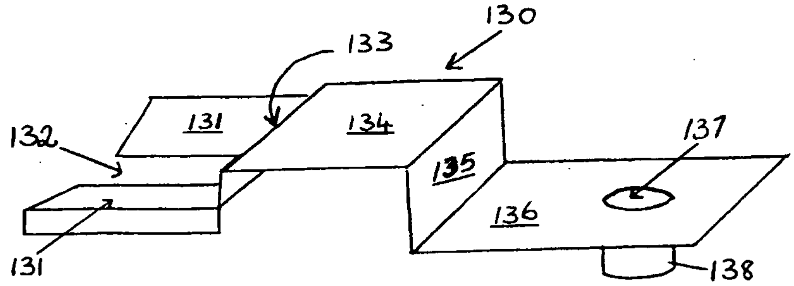

Fig. 16

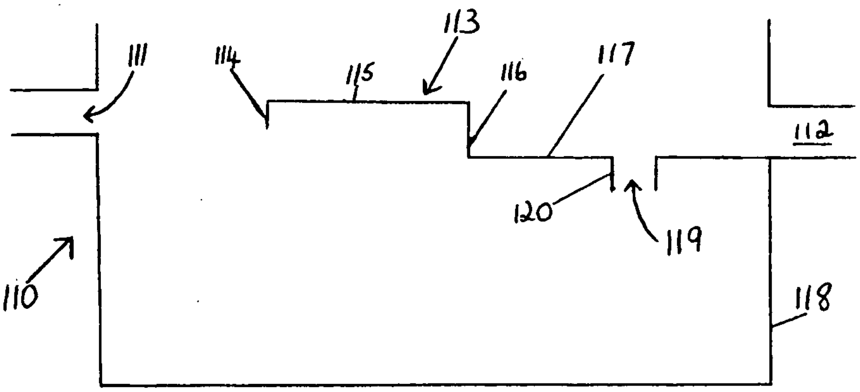

Fig. 15

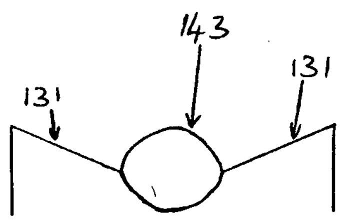

Fig. 18